

Claims

What is claimed is:

1. A switch assembly for controlling an electrical load, the switch assembly comprising:

a switch mechanism including a pivot member supported for pivoting about an axis and a switch plate adapted for movement between first and second fixed positions through contact with the pivoting pivot member; and

an actuator assembly including a slidably supported pushbutton, the actuator assembly adapted to engage the switch mechanism during inward translation of the pushbutton in response to force applied to the pushbutton for switching the switch mechanism between the first and second fixed positions, the actuator assembly adapted to outwardly bias the pushbutton for return translation of the pushbutton following removal of the force from the pushbutton,

the force applied to the pushbutton varying during input traveling of the pushbutton between a fully-released pushbutton position and a fully-engaged pushbutton position, the relationship between actuator force and pushbutton travel distance defining a multiple segment input profile,

a first segment of the input profile including the fully-released position, the applied force varying in the first segment from resistance generated by the actuator assembly to provide for the outward return of the pushbutton, the applied force in at least a substantial portion of the first segment varying in substantially linear fashion along a first slope, s_1 ,

the applied force varying in the second segment from a combination of the pushbutton return resistance and resistance generated by the switch mechanism against movement between the first and second fixed positions, the applied force in at least a substantial portion of the second segment varying in substantially linear fashion along a second slope, s_2 ,

the relationship between the first and second slopes, s_1 and s_2 , being defined by the following equation:

$$0.30 \text{ (approx.)} \leq s_1/s_2 \leq 0.60 \text{ (approx.)}.$$

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2. The switch assembly according to claim 1, wherein the actuator assembly includes a return spring operably contacting the pushbutton for providing the outward return of the pushbutton following release of the applied force.

3. The switch assembly according to claim 1, wherein the switch mechanism includes a switch plate supported for movement between first and second positions associated with the first and second fixed positions of the switch mechanism.

4. The switch assembly according to claim 3, wherein the switch mechanism includes a spring located between the pivot member and the switch plate for maintaining the switch plate in either one of the first and second positions of the switch plate.

5. A switch assembly for controlling an electrical load, the switch assembly comprising:

a switch mechanism including a pivot member supported for pivoting about an axis and a switch plate adapted for movement between first and second fixed positions through contact with the pivoting pivot member; and

an actuator assembly including a slidably supported pushbutton, the actuator assembly adapted to engage the switch mechanism during inward translation of the pushbutton in response to force applied to the pushbutton for switching the switch mechanism between the first and second fixed positions, the actuator assembly adapted to outwardly bias the pushbutton for return translation of the pushbutton following removal of the force from the pushbutton,

the force applied to the pushbutton varying during input traveling of the pushbutton between a fully-released pushbutton position and a fully-engaged pushbutton position from resistance respectively generated by the actuator assembly for outward return of the pushbutton and by the switch mechanism against switching

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movement, the relationship between actuator force and pushbutton travel distance defining a multiple segment input profile,

the applied force having a value F_s at a pushbutton travel distance of d_s when sufficient force has been applied to the pushbutton for switching actuation of the switch mechanism to occur, the applied force reducing from F_s at travel distance d_s to F_r at a pushbutton travel distance d_r as the resistance against switching actuation is removed, the travel distance at the fully-engaged position having a value d_e ,

the input profile values of F_s , F_r , d_s , d_r and d_e defining a substantially V-shaped portion of the profile according to the following equations:

- A. $(d_r - d_s)/d_r \leq 0.15$ (approx.)
- B. 0.10 (approx.) $\leq (d_e - d_r)/d_e \leq 0.30$ (approx.)
- C. 0.10 (approx.) $\leq (F_s - F_r)/F_s \leq 0.30$ (approx.).

6. The switch assembly according to claim 5, wherein the actuator assembly includes a return spring operably contacting the pushbutton for providing the outward return of the pushbutton following release of the applied force.

7. The switch assembly according to claim 5, wherein the switch mechanism includes a switch plate supported for movement between first and second positions associated with the first and second fixed positions of the switch mechanism.

8. The switch assembly according to claim 7, wherein the switch mechanism includes a spring located between the pivot member and the switch plate for maintaining the switch plate in either one of the first and second positions of the switch plate.

9. The switch assembly according to claim 5, wherein the applied force of the input profile reaches a value of F_e at d_e , and wherein F_e is less than F_s .

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10. A switch assembly for controlling an electrical load, the switch assembly including an actuator assembly and a switch mechanism, the actuator assembly releasably engageable with the switch mechanism to switch the mechanism between first and second fixed electrical states, the actuator assembly comprising:

a pushbutton received by a pushbutton guide for inward translation of the pushbutton with respect to the switch assembly;

a return member for outwardly biasing the pushbutton with respect to the switch assembly;

a retainer located between the pushbutton and the switch mechanism, the retainer providing a reaction surface engaged by the return member for outwardly biasing the pushbutton;

an elongated actuator member having switch-engaging and pushbutton-engaging portions at opposite ends of an intermediate portion, the pushbutton-engaging portion of the actuator located between the retainer and the pushbutton, the intermediate portion of the actuator dimensioned for translatable receipt through an opening in the retainer,

the elongated actuator member operably driven by the pushbutton during inward translation of the pushbutton for releasable engagement between the switch-engaging portion of the actuator member and the switch mechanism,

the opening in the retainer being elongated to provide for lateral pivoting of the actuator member with respect to the retainer during switching of the switch mechanism.

11. The switch assembly according to claim 10, wherein the pushbutton includes a cap defining an interior and a carrier, the carrier including a stand portion and a pedestal portion, the stand portion of the carrier adapted for receipt within the interior defined by the cap.

12. The switch assembly according to claim 11, wherein the pushbutton guide includes opposite end walls and wherein the pedestal portion of the

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pushbutton carrier is dimensioned for sliding translation between the end walls of the pushbutton guide.

13. The switch assembly according to claim 11, wherein the pushbutton carrier includes tab projections adapted for engagement with openings in the pushbutton cap for releasably securing the pushbutton cap to the pushbutton carrier.

14. The switch assembly according to claim 10, wherein the return member is a spring having coils and wherein the actuator member is a pin including an elongated shaft portion and a head portion, the shaft portion receivable within the coils of the return spring through a first end of the return spring, the head portion defining a shoulder dimensioned for contact with the first end of the return spring.

15. The switch assembly according to claim 14, wherein the return spring is conical in shape to provide for the lateral pivoting of the pin and wherein the actuator assembly further comprises a receptacle connected to the pushbutton, the receptacle defining a bell-shaped interior dimensioned for receipt of the conical return spring.

16. The switch assembly according to claim 10, wherein the pushbutton guide includes opposite end walls and wherein the actuator assembly includes tab projections connected to the end walls of the pushbutton guides, the tab projections adapted for receipt within openings in the retainer for releasably securing the retainer to the pushbutton guide.

17. The switch assembly according to claim 10, wherein the switch assembly further includes a base housing in which the switch assembly is mounted and wherein the pushbutton guide is connected to an actuator mount adapted for receipt by the base housing.

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18. The switch assembly according to claim 17, wherein the actuator mount includes at least one projecting portion dimensioned for receipt within a recess formed in an upstanding sidewall of the base housing.

19. The switch assembly according to claim 10, wherein the switch mechanism includes a pivot member supported for pivoting about an axis and a switch plate supported for switching movement between first and second positions associated with the first and second fixed electrical states.

20. The switch assembly according to claim 19, wherein the pivot member is adapted for contact with the switch plate during pivoting of the pivot member.

21. The switch assembly according to claim 14, wherein the switch mechanism includes a pivot member supported for pivoting about an axis, the pivot member including a body defining a cross section having a substantially V-shaped middle portion and opposite end portions defining ledge extensions, the pin shaft laterally pivoting upon contact with the V-shaped middle portion of the pivot member body and translating along the body middle portion for contact with one of the opposite ledge extensions.

22. A switch assembly for controlling an electrical load, the switch assembly including a switch mechanism and an actuator assembly having a slidably supported pushbutton, the actuator assembly adapted to engage the switch during inward translation of the pushbutton, the switch mechanism comprising:

a switch plate having opposite upper and lower edges, the switch plate including at least one recess along the lower edge to define supports at opposite ends of the switch plate having contact surfaces for supporting the switch plate on a support surface;

a pivot member supported for pivoting about an axis; the pivot member adapted for contact with the switch plate adjacent the upper edge of the support plate

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such that pivoting of the pivot member causes switching movement of the switch plate;

first and second contact elements secured to opposite sides of the switch plate, the contact elements respectively contacting first and second fixed contact surfaces of the switch assembly when the switch mechanism is switched between alternating first and second closed contact positions; and

a spring located between the pivot member and the switch plate to apply a contact force between the contact elements and the fixed contact surfaces to maintain the switch mechanism in one of the alternate closed contact positions, the switch plate including at least one recess along the upper edge for receiving one end of the spring, the at least one recess in the upper edge extending to a terminal end located to provide for substantial alignment between the end of the spring and a center of each of the contact elements.

23. The switch assembly according to claim 22, wherein the switch mechanism further comprises a switch plate holder, the switch plate holder including a portion defining a well in which the switch plate is received for support of the switch plate by contact between the switch plate supports and a surface of the switch plate holder well.

24. The switch assembly according to claim 23, wherein the switch plate holder further includes an arm extension connected to the well portion, and wherein the arm extension defines a first one of the fixed contact surfaces.

25. The switch assembly according to claim 24, wherein the switch mechanism further includes a contact element support prong and a contact element secured to the contact element support prong, and wherein the contact element secured to the contact element support prong defines the second one of the fixed contact surfaces.

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26. The switch assembly according to claim 25, wherein the switch assembly includes a base housing in which the switch mechanism is mounted, and wherein the contact element support prong is connected to a traveler terminal received by the base housing.

27. The switch assembly according to claim 22, wherein the spring located between the pivot member and the switch plate includes coils and wherein the switch mechanism further comprises a damper received within the coils of the spring, the damper dimensioned for contact with the coils to limit resonating vibration of the coils following a change in relative angular orientation of the pivot member and the switch plate from actuation of the switch mechanism.

28. The switch assembly according to claim 22, wherein the pivot member includes a body defining a cross section that includes a substantially V-shaped middle portion and opposite end portions defining ledge extensions, and wherein the actuator assembly includes an actuator member adapted for contact with the body middle portion and translation therealong for contact with one of the body ledge extensions.

29. The switch assembly according to claim 28, wherein the actuator member of the actuator assembly is an elongated pin including a shaft portion having a tapered end for contact with the pivot member of the switch mechanism.

30. The switch assembly according to claim 29, wherein the actuator assembly further includes a retainer located between the switch mechanism and the pushbutton, and wherein the shaft portion of the pin is dimensioned for receipt through an opening in the retainer, the opening being elongated to provide for lateral pivoting of the pin with respect to the retainer during contact between the pin and the pivot member.

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31. The switch assembly according to claim 30, wherein the actuator assembly further includes a return spring for outward return of the pushbutton following actuation of the switch mechanism, the return spring including coils, and wherein the pin is received within the coils of the return spring, the pin including a head portion dimensioned for contact with an end of the return spring to provide for outward return of the pin with the pushbutton following actuation of the switch assembly.

32. A switch assembly for controlling an electrical load, the switch assembly including a switch mechanism and an actuator assembly adapted to engage the switch mechanism, the switch assembly comprising:

a pivot member supported for pivoting about an axis;

a spring having coils and located between the pivot member and an adjacently located member of the switch assembly; and

a spring damper received within the coils of the spring and contacting the coils to limit resonating vibrations of the coils following a change in relative angular orientation between the pivot member and the adjacently located member.

33. The switch assembly according to claim 32, wherein the spring damper is cylindrical.

34. The switch assembly according to claim 32, wherein the spring damper is made from a resilient material.

35. The switch assembly according to claim 32, wherein the spring damper is made from a foam material.

36. The switch assembly according to claim 32, wherein the spring has an axial stiffness, and wherein the spring damper has a stiffness that is less than the spring stiffness to limit interference by the spring damper with axial compression of the spring.

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37. A light switch assembly providing aural and visual feedback to a user, the light switch assembly comprising:

a switch mechanism including a pivot member supported for pivoting about an axis and a switch plate adapted for movement between first and second fixed positions through contact with the pivoting pivot member; and

an actuator assembly including a slidably supported pushbutton, the actuator assembly adapted to engage the switch mechanism during inward translation of the pushbutton in response to force applied to the pushbutton for switching the switch mechanism between the first and second fixed positions, the actuator assembly adapted to outwardly bias the pushbutton for return translation of the pushbutton following removal of the force from the pushbutton,

the force applied to the pushbutton varying during input traveling of the pushbutton between a fully-released pushbutton position and a fully-engaged pushbutton position from resistance respectively generated by the actuator assembly for outward return of the pushbutton and by the switch mechanism against switching movement, the relationship between actuator force and pushbutton travel distance defining a multiple segment input profile,

the applied force having a value F_s at a pushbutton travel distance of d_s when sufficient force has been applied to the pushbutton for switching actuation of the switch mechanism to occur, the applied force reducing from F_s at travel distance d_s to F_r at a pushbutton travel distance d_r as the resistance against switching actuation is removed, the travel distance at the fully-engaged position having a value d_e ,

the input profile values of F_s , F_r , d_s , d_r and d_e defining a substantially V-shaped portion of the profile,

the actuation of the switch mechanism creating an aural feedback within less than approximately 10 milliseconds of the application of force F_s to the pushbutton and visual feedback provided by illumination of a lighting load controlled by the switch within less than approximately 50 milliseconds of the application of force F_s to the pushbutton.

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38. A light switch assembly that provides aural and visual feedback to a user, the light switch assembly comprising:

a switch mechanism including a pivot member supported for pivoting about an axis and a switch plate adapted for movement between first and second fixed positions through contact with the pivoting pivot member; and

an actuator assembly including a slidably supported pushbutton, the actuator assembly adapted to engage the switch mechanism during inward translation of the pushbutton in response to force applied to the pushbutton for switching the switch mechanism between the first and second fixed positions, the actuator assembly adapted to outwardly bias the pushbutton for return translation of the pushbutton following removal of the force from the pushbutton,

the force applied to the pushbutton varying during input traveling of the pushbutton between a fully-released pushbutton position and a fully-engaged pushbutton position from resistance respectively generated by the actuator assembly for outward return of the pushbutton and by the switch mechanism against switching movement, the relationship between actuator force and pushbutton travel distance defining a multiple segment input profile,

the applied force having a value of F_c at a pushbutton travel distance of d_c when contact between the actuator assembly and the switch mechanism creates resistance that is added to the resistance provide by the actuator assembly for return of the pushbutton,

the applied force having a value F_s at a pushbutton travel distance of d_s when sufficient force has been applied to the pushbutton for switching actuation of the switch mechanism to occur, the applied force reducing from F_s at travel distance d_s to F_r at a pushbutton travel distance d_r as the resistance against switching actuation is removed, the travel distance at the fully-engaged position having a value d_e ,

the input profile including four segments respectively defined between the fully released position, distance d_c , distance d_s , distance d_r and the d_e ,

the first and second segments being substantially linear and respectively defining first and second slopes s_1 and s_2 , the value of s_1 being between approximately 30 percent and 60 percent of the value of s_2 ,

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the input profile values of F_s , F_r , d_s , d_r and d_e defining a substantially V-shaped portion of the profile,

the switching of the switch mechanism creating an audible feedback,

the light switch assembly providing for aural feedback by the switch mechanism and visual feedback by illumination of a lighting load controlled by the light switch assembly within a limited time period following application of force F_s to the pushbutton.

39. The switch assembly according to claim 38, wherein the audible feedback occurs within less than approximately 10 milliseconds of the application of force F_s to the pushbutton.

40. The switch assembly according to claim 38, wherein the visual feedback occurs within less than approximately 50 milliseconds of the application of force F_s to the pushbutton.

41. A switch assembly for controlling an electrical load, the switch assembly comprising:

an actuator assembly including a pushbutton, a pushbutton guide, a pushbutton return spring, an actuator pin and a retainer,

the pushbutton slidably received by the pushbutton guide, the retainer connected to the pushbutton guide, the pushbutton return spring located between the pushbutton and the retainer to outwardly bias the pushbutton, the actuator pin including a shaft portion received through an opening in the retainer, the retainer opening being elongated to allow for lateral pivoting of the pin shaft portion with respect to the retainer; and

a switch mechanism including a pivot member, a switch plate and a contact spring,

the pivot member supported for pivoting about a first axis, the switch plate supported along an edge of the switch plate for pivoting movement about a second axis between first and second switch plate positions, the contact spring located

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between the pivot member and the switch plate, the contact spring reacting against the pivot member to apply a force to the switch plate tending to maintain the switch plate in one of the switch plate positions.